CHUDACEK, S.

Cooperation of geophysics and geology in ore prospecting.

P. 239 (Rudy) Vol. 5, no. 7, July 1957, Praha, Czechoslovakia

SO: Monthly Index of East European Acessions (EEAI) Vol. 6, No. 11 November 1957

CHUDACEK, Z.; SPINKA, J.

Comparative results in intravenous cholangiography with biligrafin & in peroperative cholangiography. Cesk. rentg. 12 no.3:176-178 Sept 58.

1. Ustredni rtg oddeleni Statni fakultni nemocnice v Plzni, prednosta prim. MUDr. A. Cipera II. chirurgicka klinika fakulty vseob. lekarstvi v Plzni, prednosta doc. dr. J. Spinka. Z. Ch., Plzen, Marxova 13.

(CHOLANGIOGRAPHY
contrast medium, sodium iodipamide in intravenous & peroperative cholangiography comparison (Cz))
(IODIPAMIDE
sodium iodipamide in intravenous & peroperative cholangiography, comparison (Cz))

CHUDACEK, Zdenek (Plzen, Dobrovskeho 11.)

Experiences with intravenous cholangiography with biligraffin. Cas. lek. cesk. 97 no.29:897-902 11 July 58.

1. Ustredni rtg oddeleni fakultni nemocnice v Plzni, prednosta prim. Dr. A. Cipera.

(CHOLANGIOGRAPHY,
intravenous, with biligraffin (Cz))

CHUDACEK, Z.; IAHN, V.

Blood protein level and excretion of biligrafin. Cesk. rentg. 13 no.3: 192-198 June 59.

1. Ustredni rtg oddeleni, primar MUDr. A. Cipera, a ustredni laboratore, prednosta prof. MUDr. K. Bobek, stat. fakultni nemocnice v Plzni. M.S. Praha 1, Mala Strana, U Zelezne lavky 6/557. Zd. Chudacek, ustr. rtg odd. KUNZ, Marxova 13, Plzen.

(CHOLECYSTOGRAPHY
eff. of dysproteinemia on biligrafin excretion (Cz))
(BLOOD PROTEINS
dysproteinemia, eff. on biligrafin excretion in cholecystography (Cz))

CHUDACEK, Zdenek; SPINKA, Josef

Sources of difficulties in evaluation of peroperative cholangiograms. Cesk.rentg. 14 no.5:314-320 O '60.

1. Ustredni rtg oddeleni SVN v Plzni, prednosta doc. dr. Frant. Holik II. chirurgicka klinika lek. fak. v Plzni, prednosta doc. dr. Josef Spinak.
(CHOLANGIOGRAPHY)

VALENTA, Jiri; CHUDACEK, Zdenek

Conditions of the deep venous system and lymphatic vessels in leg ulcers. Acta univ. carol. [Med] Suppl. 15:109-112 '61.

1. II. chirurgicka klinika lekarske fakulty University Karlovy se sidlem v Plzni, prednosta doc. dr. J. Spinka.

(VARICOSE ULCER radiog) (ANGIOGRAPHY)
(LYMPHATIC SYSTEM radiog)

ANDEL, Z.; VALENTA, J.; CHUDACEK, Z.

Phlebographic and functional findings following Moskowicz operation for varicose veins. Acta univ. carol. [Med] Suppl. 15:121-129 '61.

1. II. chirurgicka klinika lekarske fakulty University Karlovy se sidlem v Plzni, prednosta doc. dr. J. Spinka.
(VARICOSE VEINS surg) (ANGIOGRAPHY)

PETERA, V.; CHUDACEK, Z.; LAHN, V.; technicka spoluprace VELISKOVA, L.

Effect of methyltesterone on the secretion of biligrafin into the biliary tract. Cesk. gastroent. vyz. 15 no.4:247-249 Jl '61.

1. Klinika chorob vnitrnich v Plzni, prednosta prof. dr. K.Bobek Centralni rtg oddeleni KUNZ v Plzni.
(CONTRAST MEDIA metab) (TESTERONE rel cpds)
(CHOLANGIOGRAPHY)

CHUDACEK, Z.

On the interpretation of failure in intravenous biligrafin cholangiography. Cas.lek.cesk 100 no.37:1167-1169 15 S '61.

1. II chirurgicka klinika v Plzni, prednosta doc. dr. J. Spinka.

(CHOLANGIOGRAPHY compl)

CHUDACEK, Z.

Our experience with biligrafin cholangiocholecystography in acute abdominal conditions. Cesk. gastroent. 16 no.1:61-64 Ja '62.

1. Ustredni rtg oddeleni Statni fakultni nemocnice v Plzni, zastupujici vedouci MUDr. Z. Chudacek.

(CHOLECYSTOGRAPHY) (CHOLANGIOGRAPHY)
(IODIPAMIDE) (ABDOMEN ACUTE)

CHUDACEK, Z.

Flexible reinforcing foils of the Czechoslovakian production. Cesk. rentgenol. 16 no.2:140-141 Ap '62.

1. Ustredni rig-oddeleni SFN v Plzni, zastupajici vedouci lekar dr. Z. Chudacek.

(RADIOGRAPHY equip & supply)

CHUDACEK, Zdenek; SPINKA, Josef; SEBOR, Jindrich

On the problem of possible hazards in splenoportography. Cesk. rentgenol. 16 no.3:160-164 Je '62.

1. Rentgenove oddeleni Ustredni vojenske nemocnice v Praze, predn. dr. F. Sykora.
(ANGIOGRAPHY compl)

VALENTA, J.; CHUDACEK, Z.

Contribution to the technic of lymphography. Rozhl. chir. 41 no.10: 710-711 O '62.

1. II. chirurgicka klinika lek. fak. KU v Plzni, prednosta doc. dr. J. Spinka.

(LYMPHATIC SYSTEM) (DYES)

CHUDACEK, Z.; LAHN, V.; Technicka spoluprace: VELISKOVA, L.

Dehydrocholand biligraphy. Cesk. rentgen. 17 no.4:261-263 Jl '63.

1. Ustredni rentgenove oddeleni Statni fakultni nemocnice v Plzni, vedouci MUDr. Z. Chudacek, CSc. Ustredni biochemicka laborator Statni fakultni nemocnice v Plzni, vedouci MUDr. et RNDr. V. Lahn.

(CHOLANGIOGRAPHY) (CHOLECYSTOGRAPHY)
(BILE ACIDS AND SALTS)

CHUDACEK, Z.

Angiographic picture of parapelvic lipoma. Cesk. rentgen. 17 no.6:374-376 N '63.

1. Ustredni rentgenologicke oddeleni Statni fakultni nemocnice v Plzni vedouci MUDr. Z. Chudacek.
(KIDNEY NEOPLASMS) (LIPOMA)
(NEOPLASM DIAGNOSIS) (ANGIOGRAPHY)
(RENAL VEINS)

CHUDACEK, Z.; SEBOR, J.

Our experiences with splenoportography in the diagnosis of epigastric tumors and evaluation of their operability. Cesk. rentgen. 18 no.4:243-247 Jl '64

1. Ustredni rentgenol. odd. fakultni nemocnice v Plzni (vedouci: doc.dr. Z. Chudacek, CSc.) a I. chirurgicka klinika lekarske fakulty KU [Karlovy university] v Plzni (prednosta: doc. dr. J. Spinka).

CHUDACEK, Zdenek

Our experiences with simple mastography. Plzen. lek. sborn. 23: 77-80 '64

1. Ustredni RTG oddeleni Statni fakultni nemocnice v Plzni (prednosta: doc. MUDr. Z.Chudacek, CSc.).

CHUDACEK, Z.

Reflux wirsungography. Cesk. radiol. 19 no.2:104-108 Mr '65.

1. Ustredni rentgenologicke oddeleni fakultni nemocnice v Plzni (vedouci: doc. dr. Z. Chudacek, CSc.).

CHUDACEK, Z., doc. dr.; BILDER, J.; NOVAK, V.; VALENTA, J.

Lymphography in practice. Cesk. radiol. 19 no.2:112-115 Mr '65.

1. Ustredni rentgenologicke oddeleni fakultni nemocnice v Plzni (vedouci: doc. dr. Z. Chudacek, CSc.) a I. chirurgicka klinika lekarske fakulty Karlovy University w Plzni (prednosta: doc. dr. J. Spinka).

CHUDACEK, Z.; SEBOR, J.

Cholestasis and splenoportography. Cesk. radiol. 19 no.4/5: 323-325 Ag '65.

1. Ustredni rentgenologicke oddeleni fakultni nemocnice v Plzni, CSSR a I. chirurgicka klinika lekarske fakulty Karlovy University v Plzni, CSSR.

CHUDAKOV, A.

PZ

PHASE I BOOK EXPLOITATION SOV/4890

Pravda

Besprimernyy nauchnyy podvig; materialy gazety "Pravda" o trekh sovetskikh kosmicheskikh raketakh (Unparalleled Scientific Achievement: Materials From "Pravda" on 3 Soviet Cosmic Rockets) Moscow, Gos. izd-vo fiziko-matematicheskoy lit-ry, 1959. 202 p. 50,000 copies printed.

PURPOSE: This book is intended for the general reader.

COVERAGE: The book contains articles from "Pravda", announcing the launching of three Soviet cosmic rockets on 2 January, 12 September, and 4 October 1959. Articles which describe details and observations of the flights of the rockets are included and are illustrated by diagrams and photographs. The book contains nontechnical contributions by several Soviet scientists. No personalities are mentioned. There are no references.

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AVAILABLE: Library of Congress (TL796.5.R8P66)

Card 4/4

AC/dfk/fal
3-20-61

CHUDAKOV, A.

Trade unions organize public control of commercial enterprises. (MIRA 12:2)
Sov.torg. no.2:7-9 F '59.
(Retail trade)

IVANOV, G. (Moskva); CHUDAKOV, A. (Moskva)

Index of cost reduction. Sots.trud 7 no.7:66-67 Jl '62.
(MIRA 15:8)

(Costs, Industrial) (Bonus system)

BELYAYEV, V.S.; BORISENKO, L.D.; BORISENKO, E.V.; KORABLEV, A.A.; KOLYSHKIN, O.M.; KUTLUNIN, V.A.; MALYAGIN, M.S.; SOKOLOV, A.I.; CHUDAKOV, A.I.; ABRAMOV, V.I., otv.red.izd-va; BOLDYREVA, Z.A., tekhn.red.

[Manual for the coal mine mechanic] Spravochnik mekhanika ugol'noi shakhty. Moskva, Gos.nauchno-tekhn.izd-vo lit-ry po gornomu delu, 1960. 612 p. (MIRA 13:12)
(Coal mining machinery)

CHUDAKOV, A.

Regulating wages of employees in grain product enterprises. Sots. trud 5 no.8:46-52 Ag '60. (MIRA 13:11)
(Grain trade) (Wages)

OSIPOV, I.; CHUDAKOV, A.

For communist labor in commerce. Sov. torg. 34 no.11:17-20 N '60.
(MIRA 13:11)

(Retail trade) (Socialist competition)

ACCESSION NR: AP4033366 S/0103/64/025/003/0428/0430

AUTHOR: Chudakov, A. D. (Moscow)

TITLE: Algorithm for comparing two binary numbers

SOURCE: Avtomatika i telemekhanika, v. 25, no. 3, 1964, 428-430

TOPIC TAGS: binary number, binary number comparison algorithm

ABSTRACT: The known special digital-comparison schemes (by R. Brooks, I & CS, May60, and by M. J. Boswell, I & CS, Jan61) use a serial algorithm. This article proposes a parallel (higher-speed) algorithm and these logical relations:

$$y_j^{(l)} = (y_{j-1}^{(l)} \& \overline{x_{j-1}^{(l)}}) \vee [\overline{(y_{j-1}^{(l)} \vee x_{j-1}^{(l)})} \& y_{j-1}^{(l-1)}],$$

$$x_j^{(l)} = (x_{j-1}^{(l)} \& \overline{y_{j-1}^{(l)}}) \vee [\overline{(x_{j-1}^{(l)} \vee y_{j-1}^{(l)})} \& x_{j-1}^{(l-1)}]$$

for modulus comparison of two n-digit binary numbers, where $n = 2^k$. The

Card 1/2

ACCESSION NR: AP4033366

orders are compared in parallel, and the comparison results are sent to a common output through a pyramid-type scheme. Orig. art. has: 1 figure and 6 formulas.

ASSOCIATION: none

SUBMITTED: 19Apr63 DATE ACQ: 15May64 ENCL: 00

SUB CODE: MA, DP NO REF SOV: 000 OTHER: 002

Card 2/2

L 31523-66 EWT(d)/T/EWP(1) IJP(c) BB/GG
ACC NR: AP6007862 SOURCE CODE: UR/0103/66/000/002/0066/0069

49
B

AUTHOR: Chudakov, A. D. (Moscow)

ORG: none

TITLE: The construction of adding and subtracting units, operating in an unweighted Grey code, from weighted module cells

SOURCE: 16C Avtomatika i telemekhanika, no. 2, 1966, 66-69

TOPIC TAGS: error correcting code, cyclic coding, computer coding, computer component

ABSTRACT: The application of cyclic codes 16 for the digital representation of analog quantities with subsequent conversion into the binary code does not eliminate the dynamic conversion error. This error is particularly appreciable in the construction of code converters of slow-action cells, or in the coding of extremely fast-response processes. In order to eliminate such errors, the present author proposes the construction of digital systems which process input data in the Grey code. The author develops the structure of

Card 1/2 UDC: 681.142.621

L 31523-66
ACC NR: AP6007862 O

single-cycle, one-type base addition and subtraction units in the Grey code, and deduces expressions of the eigenfunctions of these cells. Orig. art. has: 2 figures and 6 formulas.

SUB CODE: 09 / SUBM DATE: 12Mar65 / OTH REF: 001

Card 2/2 IC

L 43707-66 EWT(d)/EWP(1) IJP(c) BB/GG
ACC NR: AP6023671 SOURCE CODE: UR/0103/66/000/004/0155/0161

AUTHOR: Pochtar', Yu. S. (Moscow); Chudakov, A. D. (Moscow)

44
B

ORG: none

TITLE: System for the static testing of a combinative unit for comparing two quantities given in binary form

SOURCE: Avtomatika i telemekhanika, no. 4, 1966, 155-161

TOPIC TAGS: digital computer, computer component, binary code, algorithm, binary logic, binary number

ABSTRACT: The authors discuss a unit for the comparison of two binary-represented quantities; the unit is the fundamental component of various digital control and adjustment systems. A system of tests has been devised and is considered in this article for an n-place combinative comparison unit which realizes a special algorithm described elsewhere (A. D. Chudakov. Ob algoritme svravneniya dvukh dvoichnykh chisel. Avtomatika i telemekhanika, vol. XXV, No. 3, 1964). Using this test system, from a total of 2^{2n} possible input combinations a minimal number is selected which will ensure verification of all the possible conditions of the elementary logical operations performed by the combinative comparison unit during the comparison

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L 43707-66

ACC NR: AP6023671

of two binary numbers. Individual unit cell operation is analyzed and an intermediate state table for the logical operations performed is tabulated. The comparison unit considered is constructed of pyramidally arranged comparison cells and consists of a pyramid of three cells, two of which are located at the base and one at the apex of the structure. Such a unit, known as a "second-order pyramid" because of the number of "tiers" in the arrangement, has a total number of possible input combinations of $N = 2^{2.4} = 256$. Other modifications of this basic type are also considered and state charts are compiled. Orig. art. has: 2 figures and 3 tables.

SUB CODE: 09,12/ SUBM DATE: 31May65/ ORIG REF: 001

Card 2/2

L 08219-67

ACC NR: AP6030331 SOURCE CODE: UR/0170/66/011/002/0161/0165

AUTHOR: Slobodyannikov, S. S.; Chudakov, A. D.; Pelipenko, V. I. 50 B

ORG: Moscow Technological Institute (Tekhnologicheskiy institut g. Moskva)

TITLE: Electric simulation of reciprocally moving fields

SOURCE: Inzhenerno-fizicheskiy zhurnal, v. 11, no. 2, 1966, 161-165

TOPIC TAGS: simulation, temperature simulation, electric analog, field theory, TEMPERATURE DISTRIBUTION, MECHANICAL ENGINEERING

ABSTRACT: An electrical analog computer developed by the Moscow Technological Institute for simulating problems of field theory involving reciprocal movements of field elements is described. The problem of determining the thermal distribution in the brake system of a hoisting rig is considered and solved by using the analog computer described here. A schematic drawing of the network analog computer and an oscillogram of the temperature variations in a brake drum in terms of the turning angle of the drum are given. Orig. art. has: 3 figures and 2 formulas. [AB]

SUB CODE: 09, 18/ SUBM DATE: 12Mar66/ ORIG REF: 005/ OTH REF: 002

Card 1/1 egk UDC: 536.2

CHUDAKOV, Arkadiy Il'ich; FOMENKO, I.P., red.

[Local trade-union committee of a commercial enterprise] Mestkom profsoiuza torgovogo predpriiatiia. Moskva, Profizdat, 1965. 77 p. (MIRA 18:10)

CHUDAKOV, A.

Wages for workers in the enterprises and organizations of the grain trade system. Sots. trud 8 no.9:139-142 S '63. (MIRA 16:10)

CHUDAKOV, A. Ye.

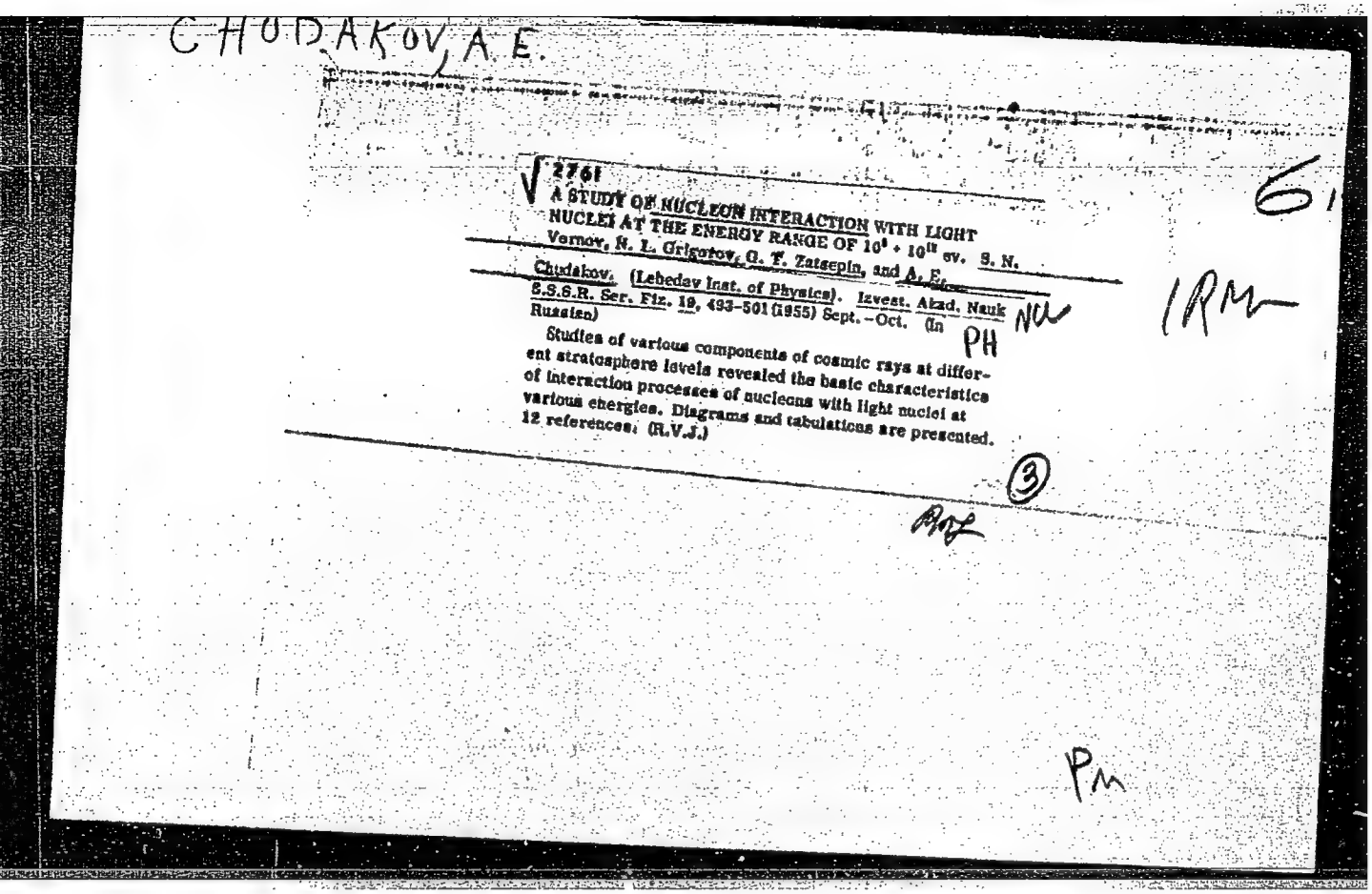
USSR/Mathematics-Statistics
Nuclear Physics-Proportional Counters Jun 49

"Statistics of Errors in Operations With Counting Devices," I.Ya. Barit, M. I. Podgoretskiy, A. Ye. Chudakov, Phys Inst imeni P. N. Lebedev, Acad Sci USSR, 8pp

"Zhur Tekh Fiz" Vol XIX, No 6

Derives formula to calculate errors in operations with counting devices (Geiger counter) for various assumptions relative to the "dead" time of the registering unit. Gives corresponding curves. Submitted 18 Jun 48

PA 46/49T51



CHUDAKOV, A. E.

61

2761
A STUDY OF NUCLEON INTERACTION WITH LIGHT NUCLEI AT THE ENERGY RANGE OF $10^9 \div 10^{12}$ ev. S. N. Vernov, N. L. Grigorov, G. T. Zatsepin, and A. E. Chudakov. (Lebedev Inst. of Physics). Izvest. Akad. Nauk S.S.S.R. Ser. Fiz. 19, 493-501 (1955) Sept.-Oct. (In Russian)

Studies of various components of cosmic rays at different stratosphere levels revealed the basic characteristics of interaction processes of nucleons with light nuclei at various energies. Diagrams and tabulations are presented. 12 references. (R.V.J.)

NW

1RM

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3

PM

CHUDAKOV, A.Ye.

On an ionization effect linked to an observation on electron-positron pairs at very high energies. Izv.AN SSSR Ser.fiz.19 no.6:651-656 N-D '55. (MLRA 9:4)

1.Fizicheskiy institut imeni P.N.Lebedeva Akademii nauk SSSR.
(Cosmic rays) (Nuclear physics)

GOL'DANSKIY, V.I.; ZHDANOV, G.B.; NESTEROVA, N.M.; CHUDAKOV, A.Ye.

Cerenkov radiation in extensive air showers. Izv.AN SSSR.Ser.fiz.19 no.6:747-748 N-D. '55. (MLRA 9:4)

1.Fizicheskiy institut imeni P.N.Lebedeva Akademii nauk SSSR.
(Cosmic rays) (Nuclear physics)

CHUDAKOV, A. Ye.

USSR/Nuclear Physics - Cherenkov radiation FD-1865

Card 1/1 Pub. 146-25/25

Author : Nesterova, N. M., and Chudakov, A. Ye.

Title : Observation of Cherenkov radiation accompanying wide atomspheric cosmic-ray showers

Periodical : Zhur. eksp. i teor. fiz. 28, 384, March 1955

Abstract : Cherenkov radiation arising during the passage of fast charged particles through matter must take place not only in dense media, but also in air under condition of sufficiently great speed of the particles, the intensity of radiation of the individual particles being very small but the total effect of the atomsphere recordable against the radiation background of the night sky. The theoretical discussion of this phenomenon was given by V. I. Gol'danskiy and G. B. Zhdanov (ibid., 26, 405, 1954). Here the authors discuss preliminary attempts to investigate flashes in the night-sky radiation and to establish their connection with wide atmospheric showers, on the bases of work conducted at 3860 meters above sea level.

Institution: Physics Institute im. P. N. Lebedev, Academy of Sciences USSR

Submitted : November 30, 1954

JANOSSY, L.

CHUDAKOV, A.Ye.

21(1) PHASE I BOOK EXPLOITATION SOV/1911

International Conference on Cosmic Radiation. Budapest, 1956.

International Conference on Cosmic Radiation Organized by the Hungarian Academy of Sciences. Budapest, 1957. 187 p. 800 copies printed.

Sponsoring Agency: Magyar Tudomanyos Akademia

Eds.: E. Fenyves, and A. Somogyi

PURPOSE: This report is intended for geophysicists concerned with cosmic radiation.

COVERAGE: This report contains the papers read at the six plenary sessions of the conference. Some of the problems dealt with include nuclear emulsions, extensive air showers and the program of cosmic ray measurements planned for the International Geophysical Year. Most of the reports are followed by references. Soviet scientists in the field of cosmic radiation who attended the conference are: E.L. Andronikashvili, N.A. Dobrotin, I.I. Gurevich, S.L. Nikolskiy and S.N. Vernov. The articles are written in English, German and Russian without parallel translations.

Card 1/6

International Conference (Cont.) SOV/1911

3. Nikol'skiy, S.I. The Study of Nuclear Active Components of Extensive Atmospheric Showers of Cosmic Rays 50
4. Vernov, S.N., and Zatsepin, G.T. Height Dependence and the Problem of the Core of Extensive Atmospheric Showers (not incl.)
5. Chudakov, A.Ye. Cherenkov Radiation of Extensive Atmospheric Showers of Cosmic Rays 57
6. Andronikashvili, E.L., and N.F. Bibilashvili. The Study of the Spatial Dispersion of Penetrating Particles of Extensive Atmospheric Showers 63

THIRD SESSION

EXTENSIVE AIR SHOWERS

1. Babecki, J.L. Jurkiewicz, and J.M. Massalski. The Transition Curve of the Electron-Photon Component of Extensive Air Showers in Lead Absorbers of Thicknesses Between 0 and 25 cm. 73
2. Janossy, L., T. Sandor, and A. Somogyi. Investigation of Extensive Air Showers 230 m. Above Sea Level 96

Card 3/6

CHUDAKOV, A Ye

AUTHORS: Voykovskiy, B.A., Galaktionov, A.I., Tret'yakova, M.I. and Chudakov, A.Ye. 120-6-8/36

TITLE: Photometering of Tracks Due to Charged Particles in Photographic Emulsions (Fotometrirovaniye sledov zaryazhennykh chastits v fotoemul'sii)

PERIODICAL: Pribory i Tekhnika Eksperimenta, 1957, No.6, pp. 38 - 42 (USSR).

ABSTRACT: A photometer is described which can be used to determine the density of a track in a photographic emulsion. A photograph of the apparatus is given in Fig.1 and its principles are as follows. The part of the track under investigation is made parallel to the slit of the photometer. Light which passes through the track objective and then the photometer slit is intercepted by the cathode of a photomultiplier. Depending on the density of the track the output of the photomultiplier falls or increases, as the slit is moved along and parallel to the track. The voltage across the photomultiplier load is then amplified by an amplifier and is applied to the plates of an oscilloscope. An automatic device is incorporated which ensures that the track always lies within the slit. The quantity h/H (where h is the maximum density on the axis of the track and H is the background density) was measured for protons and

Card1/3

120-6-8/36

Photometering of Tracks Due to Charged Particles in Photographic Emulsions.

τ-mesons as a function of residual range. Comparing the ranges of protons and π-mesons corresponding to the same value of h/H the ratio of the mass of the protons to that of the mesons could be calculated (for ranges between 520 and 1 100, and 3 800 - 7 000 microns for protons and π-mesons, respectively). Figs. 4 and 6 show curves of h/H as functions of range for protons, π-mesons, and τ-mesons. Using the above method, it also is possible to determine the cross-sectional profile of each track. The area under this curve is denoted by S. The following masses were found for the τ-mesons:

$$m_\tau = (1\,050 \pm 175)\, m_e \quad \text{(from h/H and the range)}$$

$$m_\tau = (985 \pm 120)\, m_e \quad \text{(from S and the range).}$$

The values for the π-mesons are as follows:

$$m_p/m_\pi = 6.4 \pm 0.6 \quad \text{(from h/H and the range)}$$

$$m_p/m_\pi = 6.6 \pm 0.5 \quad \text{(from S and the range).}$$

Card2/3 It is found that using the "S method" it is easier to separate singly-charged particles of different nature. A measurement of

Photometering of Tracks due to Charged Particles in Photographic Emulsions.

S will also yield Z for relativistic particles. V. Karpova and V. Sachkov carried out the measurements on the instrument. There are 6 figures and 7 non-Slavic references.

ASSOCIATION: Institute of Physics imeni P.N. Lebedev Ac.Sc. USSR. (Fizicheskiy Institut im. P.N. Lebedeva AN SSSR)

SUBMITTED: May 21, 1957

AVAILABLE: Library of Congress.

Card 3/3

CHUDAKOV, A.Ye.

53-1-10/18

AUTHOR VERNOV, S.N., LOGACHEV, Yu.I., CHUDAKOV, A.E., SHAFER, Yu.G.

TITLE The Investigation of the Variations of Cosmic Radiation (Issledovaniye variatsiy kosmicheskogo izlucheniya, Russian)

PERIODICAL Uspekhi Fiz. Nauk, 1957, Vol 63, Nr 1b, pp 149 - 162 (U.S.S.R.)

ABSTRACT

The present paper reports on the problem of the use of an artificial satellite for the study of the variations of cosmic radiation. By means of a comparatively simple apparatus consisting of a counter and ionization chamber the following phenomena can be studied: a) the variations of the primary cosmic radiation. b) the variations of the multiply charged component of the primary cosmic radiation which consists of helium nuclei and heavier atoms. c) the geomagnetic field at great distances from the earth. d) the albedo of the earth for cosmic radiation. e) the structure of currents emitted by the sun.

I. Possibilities offered by the artificial earth satellites for the investigation of the variations. The variations of the secondary cosmic radiation differ essentially from the variations of the primary radiation. It is just for that reason that the study of the variations of the primary radiation is desirable. The variations recorded at sea level are usually much smaller than the variations of primary radiation. The measurements obtained by means of rockets are very inaccurate because of the short stay of the rockets in high altitudes, but artificial earth

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satellites offer great possibilities in this respect. Simultaneous measurements by counters and ionization chambers make a comparison of the variation of intensity of the primary protons with the variation of the intensity of the heavier primary nuclei possible. The variations have to be determined in the various regions of the energy spectrum of cosmic radiation. This is only possible on satellites with suitably selected orbits. The measurements of the intensity above the polar regions are of special interest.

II. The various phenomena which can be studied by an apparatus fixed in the satellite. The authors here consider the case that the satellite flies over the poles and is half of the time in the earth's shadow. Further, the measurement data can be transmitted during the entire time of the satellite's existence. The experimental material thus obtained on one single day by far surpasses the hitherto existing material this field. By a comparison of the material obtained from various revolutions and on various days the variations of intensity of the cosmic radiation can be concluded. If the data for the intensity and for the ionisation power of cosmic radion over the entire surface of the globe is available, interesting conclusions concerning the following phenomena may be drawn.

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The Investigation of the Variations of Cosmic Radiation

1.) the alteration of intensity in time (great irregularities of intensity in connection with eruptions of the solar chromosphere, reduction of intensity during magnetic storms, the variation (one and a half hour variation)) connected with the revolution of the satellite round the earth, the variations of intensity of the heavy nuclei of primary cosmic radiation, the long-time periodic variations, the experimental verification of the conncetion between primary and secondary variations. 2.) the earthmagnetic field and the interplanetary magnetic field. 3.) the alteration of the earth's albedo for cosmic radiation. 4.) the search for electrons and photon in the primary cosmic radiation.

III. The apparatus for the study of the variations of cosmic radiation outside the earth's atmosphere can determine these variations by measuring the variations of the ionization or the variations of particles passing through a counter. The influence of a possible revolution of the satellite is pointed out, but this variation can at least partially be compensated by fixing two counters to the satellite. For the radiotechnical equipment semiconductor triodes and tiratrones with a cold cathode are used. The following elements of the apparatus are discussed more in details: a) the counters of the charged particles, and b) the

53-1b-10/18

The Investigation of the Variations of Cosmic Radiation counting method by means of semicondcutor triodes. (5 illustrations)

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Semikov, N.I.

29(0) PV PHASE I BOOK EXPLOITATION SOV/1658

Akademiya nauk SSSR

Iskusstvennyye sputniki zemli, vyp. 1: Rezul'taty nauchnykh issledovaniy, provedennykh po programe MGG pri pomoshchi pervogo i vtorogo iskusstvennykh sputnikov zemli (Artificial Earth Satellites, Nr 1: Results of Scientific Studies Carried Out in Accordance With the IGY Program by Means of the First and Second Artificial Earth Satellites) Moscow, Izd-vo AN SSSR, 1958. 95 p. 3,500 copies printed. [Microfilm and Zerox Copy]

Resp. Ed.: L.V. Kurnosova; Ed. of Publishing House: D.M. Alekseyev; Tech. Ed.: T.V. Polyakova.

PURPOSE: This collection of articles is the first in a series to be published regularly and is intended to disseminate to the scientific community data collected in investigations performed by means of artificial earth satellites.

COVERAGE: This collection includes papers covering scientific data obtained from the first and second Soviet artificial earth satellites. Among the areas reported on are measurements of cosmic radiation, atmospheric density, electron

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concentration in the ionosphere, and biological studies of an animal occupant of a satellite. Papers on the motions and perturbations of satellite orbits and optical and Doppler methods of satellite tracking are also included. Coverage of the individual articles is given in the Table of Contents.

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Preface [L.V. Kurnosova] 3

Vernov,S.N., N.L.Grigorov, Yu.I.Logachev, and A.Ye. Chudakov.
Measurements of Cosmic Radiation by Means of an Artificial Earth Satellite 5
This paper was first published in Doklady Akademii Nauk USSR Vol. 120, Nr 6, 1958, pp. 1231-1233. The paper presents preliminary results of measurements of cosmic-ray intensity obtained with instruments installed in Sputnik II. The close agreement of data from two separate instruments indicates the validity of these results. A brief description of the instruments and their operational characteristic are given. Since the ascending and decending segment of the orbit occurred at considerably different altitudes, it was possible to determine the relative

variation of cosmic-ray intensity as a function of altitude for the same geographic points. The intensity was found to increase considerably between 225 and 700 km, the highest altitude achieved by the satellite. This variation is attributed to three causes: a) decreased screening by the earth, b) reduction in the magnetic field of the earth permitting penetration of lower-energy particles, and c) change in the albedo of cosmic radiation. 5
There are 3 references, 1 of which is Soviet, 1 English, 1 a translation from English.

Lidov, M.L. Determination of the Density of the Atmosphere From the Observed Decelerations of the First Artificial Satellites 9

This paper presents equations relating the elements of a satellite orbit to atmospheric density. The analytical procedures used in reducing observed data on the evolution of the satellite orbit are given including an evaluation of the approximations used in obtaining solutions to the equations involved. It was assumed that in the range of altitudes considered (228-368 km) the variation of density with altitude could be approximated by the exponential function $\rho = \rho_{\pi} e^{-\frac{z - z_{\pi}}{H}}$

where ρ is the density at altitude z, ρ_{π} is the density at the perigee altitude z_{π}, and H is the altitude of the homogeneous

CHUDAKOV, A., and VERNOV, S. N.,

"Cosmic Ray and Photon Measurements from Satellites," paper presented at 10th General Assembly, Int'l Astronomical Union, Moscow, Aug 1958.

VERNOV, S.N.; VAKULOV, P.V.; GORCHAKOV, Ye.V.; LOGACHEV, Yu.I.; CHUDAKOV, A.Ye.

Studying the soft component of cosmic rays beyond the atmosphere limit. Isk.sput.Zem. no.2:61-69 '58. (MIRA 12:5)
(Cosmic rays) (Artificial satellites)

[redacted]

SOV/26-58-12-15/44

AUTHOR: Chudakov, A.Ye., Candidate of Physical-Mathematical Sciences (Moscow)

TITLE: The Study of Photons by Means of the Third Artificial Satellite of the Earth (Izucheniye fotonov pri pomoshchi tret'yego iskusstvennogo sputnika zemli)

PERIODICAL: Priroda, 1958, Nr 12, pp 88-90 (USSR)

ABSTRACT: The article is based on a paper read by the author at the session of the Fifth Assembly of the Special Committee for the Mode of Performance of the IGY and deals with new important results of photon research obtained by means of the third sputnik. The data concerning photons at high altitudes were obtained by means of a luminescence counter installed in the satellite. This counter, much more effective than a geiger counter, consisted of a cylindric natrium iodide crystal of 40 x 40 mm dimension and a photomultiplier (FEU) with a photocathode of 45 mm diameter (Fig. 1). The pulses originating on the output end of the photomultiplier were amplified by a semiconductor amplifier and transmitted to a binary network also assembled from semiconductors. The scaling factor equalled 4096. At the output end of the scaling circuit, there was a relay whose position of the contacts was

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The Study of Photons by Means of the Third Artificial Satellite of the Earth

transmitted by radio. In addition to the intensity of the counting, the position of two other relays was also transmitted by radio. These relays were for the transmission of data on the ionization accumulation. For this purpose, the current was measured at the output end of the photoelectric multiplier and also the current of its seventh dynode. The "Mayak" radiotransmitter was used for the transmission and operated constantly during the time of flight of the satellite. The transmission of information by the "Mayak" was done by means of measuring the length of the signals. The second and third signals of the "Mayak" were used according to the following code: the relay measuring the anode current in the closed condition provides the length of the second signal of the "Mayak" = 50 m/sec. An analogous relay measuring the dynode current, controls the length of the third signal. The position of the relay measuring the count is transmitted by way of altering the length of the second or third signal from 150 to 100 m/sec. The transmitted signals had to be recorded by numerous receiver points. Of the mass of data, little has been evaluated. Full information from the device was obtained for a period of

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during several solar bursts of activity on 6 June 1958. A comparison of the results points to an urgently required increase of sensitivity of the recording apparatus.
There are 2 diagrams, 1 set of graphs, and 1 table.

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The Study of Photons by Means of the Third Artificial Satellite of the Earth

more than one month of flight, while information on ionization currents continued over a considerably longer period of time. Evaluated data covering 20 hours of flight shows that the measuring results of the intensity count of X-ray radiation apparently originating from the electron bombardment of the satellite hull was highly effective. In all instances, the intensity of the count exceeds approximately 10 times or more the counting rate expected from cosmic rays. Recordings made during the flight of the satellite over the territory of the USSR, of its entering and leaving the Polar zone, are shown in Fig. 2 a and b. The analysis of many recordings of this kind permit the assumption that in the sector of increased count, only an unimportant increase in ionization takes place. The energy of the photons corresponding with the count increase is estimated at 100 kilo-electron volts. The origination of these photons can be explained by the decelerating radiation (Bremsstrahlung) that comes into being at the bombardment of the satellite hull by electrons with approximately the same energy (100 kev). Similar results were obtained at the recordings of photon intensity changes

AUTHORS: Vernov, S. N., Corresponding Member, SOV/20-120-6-18/59
Academy of Sciences, USSR, Grigorov, N. L., Logachev, Yu. I.
Chudakov, A. Ye.

TITLE: Measurement of Cosmic Radiation by the Sputnik (Izmereniye kosmicheskogo izlucheniya na iskusstvennom sputnike zemli)

PERIODICAL: Doklady Akademii nauk SSSR, 1958, Vol 120, Nr 6, pp. 1231 - 1233 (USSR)

ABSTRACT: The results discussed in this paper were obtained by equipment incorporated in the second earth satellite. In order to be able to record the variations of the intensity of the cosmic radiation in a reliable manner two similar counters for charged particles (with a length of 100 mm and a diameter of 18 mm) was mounted in the sputnik. Both devices contained counters operating on the basis of semi-conductor triodes. The power consumption of the whole apparatus was 0,15 Watts. The batteries permitted continuous operation for 200 hours. The relative increase of the intensity with altitude was computed from the ratio of the intensity of cosmic radiation on the "inverse loops" (passage from the North to the South, at an altitude of 350 - 700 km) and the intensity on the "direct loops"

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(passage from the South to the North at an altitude of 225 - 240 km) measured at the same geographical points. This variation can be caused by at least three effects: 1) An increase of intensity due to a reduction of the shielding by the earth. 2) A reduction of the intensity by the weakening of the earth's magnetic field 3) By a variation in the albedo of the cosmic radiation. The dependence of the intensity upon the altitude can be explained by the first two effects. From the data obtained by the measurements of many loops the lines of equal intensity of cosmic radiation (isocosmic lines) are obtained. Such isocosmic lines are presented for three different counting rates. The experimental points above all fit upon the geographical parallels. The line of the minimum intensity of cosmic radiation (the "cosmic equator") does not coincide with the geomagnetic equator. According to the evidence obtained the intensity of the cosmic radiation sometimes increased considerably. During this the intensity fluctuated very much. There are 4 figures and 3 references, 1 of which is Soviet.

SUBMITTED: May 4, 1958
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Measurement of Cosmic Radiation by the Sputnik SOV/2o-12o-6-18/59

1. Cosmic rays--Measurement 2. Satellite vehicles--Applications 3. Satellite vehicles--Equipment 4. Radiation--Counting methods

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CHUDAKOV, A. E.

THE SPECTRUM OF EXTENSIVE AIR SHOWERS ACCORDING TO THE NUMBER OF PARTICLES: THE COEFFICIENT OF ABSORTION OF EXTENSIVE AIR SHOWERS

1. Utilizing the method of correlated hodoscopes, which permits determining the position of the axis and the number of particles in a shower, we have obtained data on shower spectra level and at sea leve.
2. At 3860 m above sea level and the interval of particle-number variation in the shower from 3×10^4 to 10^7, the spectrum is well approximated by power law $N^{-\gamma}$ where $\gamma = 1.6\text{-}0.1$. At sea level there is a greater probability that the spectrum will be irregular in the range $10^6 \leq N < 10^7$ (for $10^4 \leq N < 10^6$ $\gamma = 2.1 \pm 0.2$, and for $N < 10^7$ $\gamma = 1.5\text{-}0.2$.
3. The shower absorption coefficient obtained from a comparison of absolute number of showers with a number of particles greater than that given at mountain altitude and at sea level, amounts to $1/(160\text{-}2\text{-})$ g/cm^2.

Report presented at the International Cosmic Ray Conference, Moscow, 6-11 July 1959

CHUDAKOV, A. YE.

21(8) PHASE I BOOK EXPLOITATION SOV/2081

International Conference on the Peaceful Uses of Atomic Energy, 2d., Geneva, 1958

Doklady sovetskikh uchenykh; yadernaya fizika (Reports of Soviet Scientists; Nuclear Physics) Moscow, Atomizdat, 1959. 552 p. (Series: Its: Trudy, Vol. 1) 8,000 copies printed.

Eds. (Title page): A.I. Alikhanov, Academician; V.I. Veksler, Academician; and N.A. Vlasov, Candidate of Physical and Mathematical Sciences; Ed. of this volume: S.I. Ereadov and B.V. Zaretskiy, Candidates of Physical and Mathematical Sciences; Ed. (Inside book): G.L. Smolyan; Tech. Ed.: Ye.I. Mazel'.

PURPOSE: This collection of articles is intended for scientific research workers and other persons interested in nuclear physics. The volume contains 43 papers presented by Soviet Scientists at the Second Conference on Peaceful Uses of Atomic Energy, held in Geneva in September 1958.

COVERAGE: It is divided into two parts. Part I contains 17 papers dealing with plasma physics and controlled thermonuclear reactions, and Part II contains 26 papers on nuclear physics, including problems of particle acceleration and of cosmic ray physics. The first paper by L.A. Artsimovich presents a review of Soviet work on controlled thermonuclear reactions. The remaining papers in Part I deal with particular problems in this field. papers in Part II deal in detail with various problems in nuclear physics, such as the fission of heavy atoms and their isotopes, and with the study of cosmic radiation by means of artificial earth satellites and rockets, described in a paper by S.N. Vernov. The Russian-language edition of the proceedings of the conference is published in 16 volumes. The first 6 volumes contain all the papers presented by Soviet scientists as follows: Volume (1), Yadernaya fizika (Nuclear Physics); Volume (2), Yadernyye reaktory i yadernaya energetika (Nuclear Reactors and Nuclear Power); Volume (3), Yadernoye goryucheye i reaktornyye metally (Nuclear Fuel and Reactor Metals), Volume (4), Khimiya radioelementov i radiatsionnykh prevrashcheniy (Chemistry of Radioelements and of Radiation Transformations); Volume 5, Radiobiologiya i radiatsionnaya meditsina (Radiobiology and Radiation Medicine); Volume (6) Polucheniye i primeneniye izotopov (Production and Use of Isotopes). The other 10 volumes contain selected papers presented at the Conference by non-Soviet scientists. In the present volume discrepancies between the English and Russian language) edition of the proceedings have been noted in three articles where the texts are not identical, viz; Andrianov, et al, "High Current Pulsed Discharge"; Akhiyezer, et al, "High Frequency Plasma Oscillation"; and Bogolyubov, "Investigations of the Many-body Problem". The serial numbers of reports 2302 and 2304 are reversed in the English edition. Report 2211, by Sinelnikov, et al, is numbered 2536 in the English edition.

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Vernov, S.N., and A.Ye. Chudakov. Cosmic Ray Studies in the USSR by Means of Rockets and Sputniks (Report 2525) 267
Personalities mentioned include A.I. Lebedinskiy, V.A. Kovalev, P.V. Vakulov, N.I. Fradk'in, V.I. Solov'yev, Yu.I. Logachev, P.V. Vakulov, and Yu.V. Gorchakov.

Flerov, G.N. Nuclear Reactions Caused by Heavy Ions (Report 2299) 272

Groshev, L.V., A.M. Demidov, V.N. Lutsenko, and V.I. Pelekhov. Spectra of Y-ray Radiation Capture of Thermal Neutrons and Distribution of Nuclear Levels (Report 2029) 281

Anton'yeva, N.M., A.A. Bashilov, B.S. Dzhelepov, [illegible] Grigor'yev, [illegible] Gromov, [illegible], A.V. Zolotavin, O.Ye. Kraft, I.M. Krisyuk, [illegible], [illegible], V.N. Pokrovskiy, V.K. Preobrazhenskiy, [illegible], V.A. Sergiyenko, P.A. Tishkin, and V. Yakovlev. Study of Neutron-deficient Rare Earth Isotopes (Report 2477) 300

Leypunskiy, A.I., O.D. Kazachkovskiy, G.Ya. Artyukhov, A.I. Baryshnikov, T.S. Belanova, V.I. Galkov, Yu.Ya. Stavisskiy, Ye.A. Stumbur, and L.E. Sherman. Measurements of Cross Sections for Fast Neutrons (Report 2219) 316

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3.2410 (1559, 2205, 2805)

AUTHORS: Chudakov, A. Ye., Nesterova, N. M., Zatsepin, V. I., and Tukish, Ye. I.

TITLE: Cherenkov radiation of extensive air showers in cosmic rays

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2, Shirokiye atmosfernyye livni i kaskadnyye protsessy, 47-55

TEXT: The results are given of measurements carried out in the autumn of 1957 at the Pamir Mountain (3860 m). The apparatus consisted of 16 light detectors and 9 hodoscope units with Geiger counters. Two types of light detectors were used for the measurements. Both types incorporated photomultipliers БС-1 (BS-1) or ФЭУ-24 (FEU-24). The apparatus included 6 detectors of the second type (with mirror). A special electronic circuit permitted measuring the magnitude of the light flares in all the detectors. After processing the data, it was possible to determine for each shower: 1) The

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Cherenkov radiation of ...

intensity of the light flux at 5 points; 2) the density of the particle flow at 9 observation points and hence the position of the shower axis and the total number of particles; 3) the direction of the shower. Various showers were analyzed, with number of particles ranging from $2 \cdot 10^4$ to $1.3 \cdot 10^7$. The dependence of the intensity of the Cherenkov light on the distance from the shower axis was obtained for showers with number of particles N ranging from $2 \cdot 10^4$ to $2 \cdot 10^7$ at intervals of 10 to 250 m. from the axis, and various angles of incidence of the showers. Assuming the relationship $E = AN$, where E is the energy spent by the shower in the atmosphere, one obtains for A approx. 10 ev. Comparing the values of the light flares from showers with different number of particles, it is possible to determine the relationship between E. and N. For showers with $N = 10^5$ to $N = 1.4 \cdot 10^6$, this relationship is $E \sim N^{0.8 \pm 0.05}$. This fact has to be taken into consideration when passing from the number spectrum to the energy spectrum of primary par-

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Cherenkov radiation of ...

ticles. Figures show that the relationship between the number of particles and the intensity of the light in the shower varies as a function of the inclination of the shower. The simultaneous measurement of the light intensity at predetermined distance from the axis, and of the total number of particles makes it possible to ascertain (in principle) the role of fluctuations in the development of showers. It was found, by comparing the fluctuations at the Pamir level and at sea level (according to measurements carried out in 1959 at Moscow State University) that the fluctuations have no significant part in explaining the altitude variation of showers. There are 9 figures and 3 references: 2 Soviet-bloc and 1 non-Soviet-bloc. The reference to the English-language publication reads as follows: W. Galbraith, J. V. Jelley. Nature, 171, no. 4347, 349, 1953. [Abstractor's note: Importance of the above investigation is stressed by K. Greisen in his article "Cosmic Ray Showers", Annual Review of Nuclear Science, v. 10, 1960, 63-108; same article also contains a critical appraisal of other results by Soviet investigators, reported in this Trudy.]

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CHUDAKOV, A. YE.

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3,2410 (1559, 1205, 1705)

AUTHORS: Kulikov, G. V., Nesterova, N. M., Nikol'skiy, S. I., Solov"yeva, V. I., Khristiansen, G. B., and Chudakov, A.Ye.

TITLE: Number spectrum of extensive air showers at altitudes of 200 and 3860 m above sea level

SOURCE: International Conference on Cosmic Radiation. Moscow, 1959. Trudy. v. 2. Shirokiye atmosfernyye livni i kaskadnyye protsessy, 87-91

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TEXT: Number spectra of extensive air showers were investigated in detail at the Physics Institute of the AS USSR and at Moscow State University. The spectra were investigated at an altitude of 3860 m and at sea level. Those at sea level were studied over a range N = $= 4 \cdot 10^3$ to $3 \cdot 10^7$. For showers with small N (10^3 to $5 \cdot 10^4$), the statistical method was used. The apparatus incorporated hodoscoped Geiger-Müller counters, whose disposition is shown in a figure. The experiments yielded the number of anti-coincidences n per unit time

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Number spectrum of ...

for counters of different σ; (σ varied between 0.4 and $1.65 \cdot 10^{-2} m^2$). By comparing the measurements and the calculations, the integral spectrum of the showers was obtained: $F(>N) = 2.5 \cdot 10^{-3} N^{-(1.45 \pm 0.03)}$ $cm^{-2} sec^{-1}$, with $N = 4 \cdot 10^3$ to 10^5. For large N, the spectrum was obtained by individual study of the showers, at sea level. For this purpose, the majority of the counters were disposed in a circle. The position of the axis and the number of particles in each shower were determined by means of the electronic computer "Strela". Thereupon the integral spectrum was found for $N = 8 \cdot 10^4$ to $8 \cdot 10^5$, viz.

$$F(>N,0) = (1{,}95 \pm 0{,}14) \cdot 10^{-10} \left(\frac{N}{10^5}\right)^{-1{,}5 \pm 0{,}1} cm^{-2} sec^{-1} sterad^{-1}$$

Both series of measurements coincide in the range $N \approx 10^5$. In order to determine the absolute number of extensive air showers in the

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Number spectrum of ...

range $N \geqslant 10^7$, the apparatus was divided into 4 groups of counters. Further, extensive air showers were studied at an altitude of 3860 m. The apparatus was controlled by photomultipliers, recording the Cherenkov radiation [Abstractor's note: See article on p. 47, this Trudy.]. The shower axis and the number of particles were determined by means of a simulator. Showers with $N = 2 \cdot 10^4$ to 10^7 were investigated. From the obtained results, the integral spectrum of showers with $N = 2.5 \cdot 10^4$ to $1.3 \cdot 10^7$ was constructed, viz.

$$F(>N,0) = (4,6 \pm 1,4) \cdot 10^{-11} \left(\frac{N}{10^6}\right)^{-(1,60 \pm 0,15)} \text{ cm}^{-2}\text{sec}^{-1}\text{sterad}^{-1}$$

The absorption length λ of showers was also determined; for showers with $N\ 10^5$, $\lambda = 156 \pm 22$ gm/cm^2. There are 4 figures and 2 Soviet-bloc references.

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Number spectrum of ...

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute im. P. N. Lebedev AS USSR); Nauchno-issledovatels'kiy institut yadernoy fiziki MGU (Scientific Research Institute of Nuclear Physics Moscow State University)

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29(2,5), 3(6) SOV/26-59-8-20/51

AUTHOR: Chudakov, A.Ye., Candidate of Physical and Mathematical Sciences and Gorchakov, Ye.V.

TITLE: Terrestrial Corpuscular Radiation

PERIODICAL: Priroda, 1959, Nr 8, pp 86-89 (USSR)

ABSTRACT: The launching of artificial earth satellites and cosmic rockets into space has opened entirely new possibilities of space investigation. An unexpected result is the discovery of the two zones of high intensively charged particles at a distance of several ten thousand kilometers from the earth' s surface (see diagram). The authors report that the newly discovered zones of high intensity undoubtedly represent sources of the charged particles that have been captured by the earth's magnetic fields. The fact of localization of these sources inside a space limited from all sides gives evidence of that. According to S.N. Vernov, this phenomenon is called terrestrial corpuscular radiation.

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Terrestrial Corpuscular Radiation

The first information upon the existence of two zones were obtained from the third Soviet sputnik. Simultaneously, the instruments of the sputnik recorded a systematic increase of ionization during its flight near the equatorial zones. Graph 1 (Figure 2) demonstrates the records of readings taken from a scintillating counter on board the diesel electric ship "Ob'" in the South American region on 12 June 1958. The article also mentions the name of A.I. Lebedinskiy. There are 2 graphs and 1 diagram.

ASSOCIATION: Fizicheskiy institut im.P.N. Lebedeva Akademii nauk SSSR/ Moskva (Physical Institute imeni P.N. Lebedev AS USSR/Moscow); Moskovskiy gosudarstvennyy universitet im. M.V. Lomonosova (Moscow State University imeni M.V. Lomonosov) (Gorchakov for both institutions).

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CHUDAKOV, M. YE

21(0)
AUTHOR: Vernov, S. N., Corresponding Member, AS USSR, Grigorov, N. L., Ivanenko, I. P., Lebedinskiy, A. I., Murzin, V. S., Chudakov, A. Ye.

TITLE: A Possible Mechanism of the Production of "Terrestrial Corpuscular Radiation" Under the Action of Cosmic Rays (Vozmozhnyy mekhanizm obrazovaniya "zemnogo korpuskulyarnogo izlucheniya" pod deystviyem kosmicheskikh luchey)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 5, pp 1022-1025 (USSR)

ABSTRACT: By "terrestrial corpuscular radiation" the authors mean the fluxes of particles moving in the terrestrial magnetic field along closed orbits. According to the authors' opinion, the following radiation production mechanism deserves the most attention: Under the action of cosmic radiation, the earth, like any other celestial body, becomes a neutron source. The neutrons traverse the magnetic field without being distorted as uncharged particles and within great distances from the earth. The charged particles originating from neutron decay move in the magnetic field along the lines of force. The particle is in the course of time reaches the region of high geomagnetic latitudes, where field strength increases considerably with increasing latitude. In this region the velocity vector of the particle will, as the particle approaches the earth, turn so long with respect to the vector $\vec{H}$, until at the latitude λ_{max} the angle between the velocity of the particle and the vector $\vec{H}$ becomes equal to 90°. At this point the particle returns and begins to move in the rear direction along the same magnetic line of force. If conditions are favourable, the decay products of the neutrons may perform 10^3 and more oscillations between the northern and the southern turning point. Therefore, the intensity of the flux of these particles increases by the same amount. Experimental data indicate the existence of such a radiation. The present paper carries out a closer investigation in order to find out by what factors the intensity of these rays is determined. Calculation is followed step by step. The authors calculate the intensity of the "terrestrial corpuscular radiation" for various heights and latitudes. The results obtained by these calculations are shown by a diagram. They lead to the following conclusions: Although the number of neutrons decaying in the earth is very small, they may cause intensive cosmic radiation. The experimentally determined intensity is by ~100 times lower near the equator than calculated intensity. According to experimental data there is no terrestrial corpuscular radiation in geomagnetic latitudes above 40°, but in the present paper $j(\lambda = 40^0) \sim j(\lambda = 0^0)$ is obtained. This means non-agreement by more than 10^3 times the amount. In order to reestablish agreement with the experiment, it is useful to assume an additional flux of particles from "magnetic traps", which are particularly strong in large latitudes. This may be due to the existence of electric fields. This assumption also appears to be confirmed by the data concerning the considerable increase of perturbations of the terrestrial magnetic field with increasing latitude. With increasing latitude, the interactions imposed upon energy by Stoermer's theory are being displayed to an ever-increasing extent. The

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ASSOCIATION: Moskovskiy gosudarstvennyy universitet im. M. V. Lomonosova (Moscow State University imeni M. V. Lomonosov)

SUBMITTED: November 21, 1958

24(7),24(8) SOV/20-125-2-16/64

AUTHORS: Vernov, S.N., Corresponding Member, AS USSR., Chudakov, A.Ye., Vakulov, P.V., Logachev, Yu.I.

TITLE: Investigation of Terrestrial Corpuscular Radiation and of Cosmic Rays During the Flight of a Cosmic Rocket (Izucheniye zemnogo korpuskulyarnogo izlucheniya i kosmicheskikh luchey pri polete kosmicheskoy rakety)

PERIODICAL: Doklady Akademii nauk SSSR, 1959, Vol 125, Nr 2, pp 304 - 307 (USSR)

ABSTRACT: The rocket launched on January 2, 1959 in the direction of the moon had apparatus for recording cosmic- and terrestrial corpuscular radiation on board. By the latter the authors mean the fluxes of fast charged particles in great altitudes, for which the terrestrial magnetic field is a so-called "magnetic trap". The particles were recorded by 2 Geiger-counters and 2 scintillation-counters. The first apparatus, with scintillation counter, was a constructive further-development of the device which the authors had built into the third Soviet Sputnik. A cylindrical sodium-iodide crystal served as a detector. The authors, above all, described the results obtained by the preliminary evaluation of the data ascertained in altitudes of from 8000 to 150000 km (from the center of the earth). A schematical drawing shows the trajectory of the rocket with

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respect to the terrestrial magnetic field. The intensity maximum is ~26000 km from the center of the earth. At a distance of 55000 km the intensity of terrestrial corpuscular radiation becomes practically equal to zero, and the remaining ionization in this distance is entirely due to cosmic radiation. According to the authors' opinion the particles oscillate along the lines of force symmetrically to the equatorial plane. The increase of intensity along a given line of force in the transition from low to high altitudes serves as an experimental proof for this assumption. The particle flux is directed not only towards one side, and, in any case, the predominant part of the particles undergoes complete reflection when approaching the earth, and is therefore subjected to oscillations from one hemisphere to the other. The trajectory of the rocket nowhere intersects the so-called internal zone. . . Actually, the apparatus built into the cosmic rocket in no range of their trajectory record particles of high energy which are characteristic of the inner zone. On the other hand, the composition of radiation is very similar to that observed by means of the third Sputnik in polar regions. Next, the composition of radiation in the outer zone with

high intensity is dealt with. In the center of the outer zone, where particle density is the greatest, the effective energy of electrons is minimal. In conclusion, cosmic radiation is dealt with. Beginning with a distance of 66000 km, the intensity of all components remains constant. The strict constants of all components at distances of from 66000 to 150000 km indicates the existence of a radiation upon which the terrestrial magnetic field exercises no influence. Therefore, either the terrestrial magnetic field vanishes at a distance of 10 earth-radii, or there are no particles with momenta of

$1.5.10^8$ to 4.10^7 ev/c in interplanetary space. The energy-flux of the photons is very low and contributes partly nothing to ionization. There are 2 figures and 4 Soviet references.

SUBMITTED: February 25, 1959

VERNOV, S.N.; CHUDAKOV, A.Ye.; VAKULOV, P.V.; LOGACHEV, Yu.I.; NIKOLAYEV, A.G.
/Associate Member, Academy of Sciences, USSR.

"Radiation Measurements During the Flight of the Second Soviet Space Rocket."

report presented at the First Intl Space Symposium, Nice, France, Jan 1960.
National Academy of Sciences of the USSR, Moscow.

VERNOV, S.N. and CHUDAKOV, A.Ye.

"Terrestial Corpuscular Radiation and Cosmic Rays."

Report presented at the 1st Intl Space Symposium, Nice, France, January, 1960.

Academy of Sciences, Moscow, USSR.

2930
S/169/61/000/006/028/039
A005/A130

3.2420 (1049, 1482)

AUTHORS: Vernov, S.N., Chudakov, A.Ye.

TITLE: Radiation research in cosmic space

PERIODICAL: Referativnyy zhurnal, Geofizika, no. 6, 1961, 10-11, abstract 6075. (Tr. Mezhdunar. konferentsii po kosmich. lucham, 1959, T. 3. Moscow, AN SSSR, 1960, 17-32)

TEXT: The authors present experimental data on investigation of cosmic radiation obtained by the second and third Soviet artificial satellites and the Soviet space rocket. Recordings were made by scintillation and Geiger-Müller counters with shields of different thicknesses. Incident to measurements at latitudes $\geq 60^{\circ}$n.lat. a pronounced increase in intensity was detected which was caused by bremsstrahlung of electrons with $E \leq 100$ kev energy. Analysis of the altitude and latitude variation of the intensity of this radiation showed that it constitutes an outer radiation belt which is approximately limited by the magnetic lines of force intersecting the earth's surface at geomagnetic latitudes 65 and

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A005/A130

Radiation research in cosmic space

55°. The mean electron energy at the outer edge (40,000 - 50,000 km from the earth's center) amounts to 50 kev, decreasing down to 25 kev towards the center of the inner radiation belt. Pronounced fluctuations of intensity in the outer belt at 400-500 km altitude were recorded. With the aid of the third satellite an inner belt of radiation was detected at about 50° latitude and below. In the western hemisphere at 15°s.lat. the lower boundary of the zone is detected even at low altitudes (~600 km) though no increase of ionization is detected at 15-20°n.lat. The southward displacement of the inner radiation belt is explained by an inclination of the axis of the geomagnetic dipole relative to the earth's axis of revolution. Furthermore, the center of the magnetic dipole is displaced toward the eastern hemisphere by about 500 km; therefore, the lower boundary of the inner radiation belt in the eastern hemisphere lies 1,000 km higher than in the western hemisphere. Analysis of the data shows that the inner radiation belt consists in the main of protons whose mean energy amounts to about 100 Mev. If these protons originate in neutron decay, their mean lifetime in the inner belt is of the order of 10^7 sec. Beyond the earth's magnetic field (more than 65,000 km from the earth's center)

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Radiation research in cosmic space

the cosmic ray intensity remained constant and amounted to about 1,800 ± 80 particles·m^{-2}·sec^{-1}·steradian^{-1}. The stream of photons with 45-450 kev energy amounted to 3,200 ± 100 quanta·m^{-2}·sec^{-1}·steradian^{-1}, and with 0.45-4.5 Mev it was 1,000 ± 100 quanta·m^{-2}·sec^{-1}·steradian^{-1}.

N. Kaminer

[Abstractor's note: Complete translation.]

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23936
S/035/61/000/006/018/044
A001/A101

3,2420

AUTHORS: Vernov, S.N., Chudakov, A.Ye., Lebedinskiy, A.I., Ivanenko, I.P.

TITLE: Composition of terrestrial corpuscular radiation and possible mechanisms of its origination

PERIODICAL: Referativnyy zhurnal. Astronomiya i Geodeziya, no.6, 1961, 33, abstract 6A287 ("Tr. Mezhdunar. konferentsii po kosmich. lucham, 1959, v. 3", Moscow, AN SSSR, 1960, 54-58)

TEXT: Assuming that the outer radiation belt consists of electrons with energy spectrum $N(>E) \sim E^{-\gamma}$, the value of γ was determined to be ~ 5 for energies from 20 to 100 kev. Extrapolation of this spectrum to the region of lower energies (3 - 10 kev) would result in density of energy of particles which would exceed the density of energy of the constraining magnetic field. Therefore, either the spectrum of low-energy electrons must have a maximum or γ should be small. A weakening of the Earth's magnetic field was observed in the seat of a maximum filled trap. A fraction of auroras can be explained by leakage of particles from the outer belt into the atmosphere. The source of replenishment of the outer zone is solar corpuscular fluxes. At their motion, recombination is possible which gives

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Composition of terrestrial corpuscular radiation ...

rise to neutral atoms. Atoms ionized about or within the radiation belt give rise to electrons captured by the magnetic field in the outer zone. The inner radiation belt is restricted by the force lines starting from the Earth's surface at latitudes 30°-40°. It is filled up at β-decay of neutrons formed in the Earth's atmosphere by cosmic rays. At life time of protons in the belt being $\sim 10^7$ sec, the neutron mechanism is sufficient for filling up the inner zone up to intensity observed. A sharp fall off of intensity in the belt at the geomagnetic latitude 30° can be explained by three mechanisms: a) non-conservation of magnetic moment of particles, b) effect of magnetic disturbances, c) drift of low-energy particles from the Earth as a result of being affected by ring currents presumed to exist in the ionosphere.

V. Temnyy

[Abstracter's note: Complete translation]

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CHUDAKOV, A. Ye.

One should not exagerate the dangers. Znan.sila 35 no.7:37-38 Jl '60. (MIRA 13:7)
(Space flight)

66010

3.9000
3.2000

AUTHORS: Vernov, S. N., Chudakov, A. Ye.

S/053/60/070/04/002/011
B006/B011

TITLE: Investigations of Cosmic Rays and Terrestrial Corpuscular Radiation in the Flights of Rockets and Sputniks

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol 70, Nr 4, pp 585-619 (USSR)

TEXT: The present article offers a survey of methods and results obtained from the investigation of corpuscular radiation in the space round the earth by means of space rockets and artificial satellites. Chapter 1: equipment (scintillation counter, gas counter, photomultiplier). Chapter 2: the outer zone of the terrestrial corpuscular radiation belt (position of this zone relative to the earth, investigation of intensity fluctuations according to the ionization effect). Chapter 3: the inner zone of the high intensity of terrestrial corpuscular radiation (position of the inner zone relative to the earth, nature and energy of the particles in the inner zone, constancy of intensity). Chapter 4: radiations outside the magnetic field of the earth (Table). Chapter 5: analysis of data obtained and possible hypotheses concerning the origin of terrestrial corpuscular radiation. Summarizingly, the following is stated: 1) The earth is surrounded by two spatially separate zones of high-intensive radiation. 2) The outer zone extends in the equatorial plane from about 20,000 to 60,000 km out from the earth center and is delimited by the lines of force of the geomagnetic field. In geomagnetic latitudes of 55 - 70°, this zone

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is observed at relatively low altitudes (300-1500 km). The intensity changes with time are considerable; in the flight of the first Russian cosmic rocket, the radiation maximum was recorded on January 1, 1959 at a distance of 26,000 km from the earth center on a line of force cutting the earth surface on the 63rd degree of latitude. In the flight of the second Russian cosmic rocket, this maximum was recorded at a distance of 17,000 km on the 59° line of force. 3) The particles occurring in this zone are electrons of two energy groups. The electrons of the first group have some ten kev. The maximum flux of electrons with energies greater than 20 kev amounts to $10^9 cm^{-2} sec^{-1} steradian^{-1}$. Electrons of the second group have energies of the order of 10^6 ev and exhibit a maximum flux of $10^5 cm^{-2} sec^{-1} steradian^{-1}$. 4) The inner zone begins on the equatorial plane at an altitude of 600 km on the Western hemisphere and extends up to distances equalling the terrestrial radius; it is delimited by a line of force on 35° latitude. The radiation intensity in this zone remains constant within about 15% in one month. 5) The particles occurring in this zone are protons of about 10^8 ev, their flux attains $10^2 cm^{-2} sec^{-1} steradian^{-1}$. On the edge of the zone in the geomagnetic interval of 35-40° latitude, a low-energy radiation (electrons of less than 10^6 ev) is

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ascertained. 6) Between the two zones, in the interval of the geomagnetic latitudes of 40-55°, there is a region in which no higher radiation intensity is detected. Provided that measurements are accurate, it may be assumed that in this region, at an altitude of 300-700 km, the flux of electrons with more than 100 kev amounts to less than one-thousandth of the flux at the boundary of the outer zone. The same ratio compared with the one at the boundary of the inner zone holds for the flux of protons with more than 10^8 ev. 7) The particle radiation outside the magnetic field of the earth consists of protons and other nuclei (flux 2 particles/cm^2.sec). The photon flux in the interplanetary space is less than 0.1 photon/cm^2.sec ($h\nu > 450$ kev) and <3photons/cm^2.sec ($h\nu > 45$ kev), respectively. 8) It is concluded from a comparison of experimental data with theoretical considerations that the high-energy protons are the result of a decay of neutrons emitted from the earth atmosphere. The radiation intensity in the center of the inner zone at low altitudes is determined by the ionization losses of the protons in the upper atmospheric layers. In geomagnetic latitudes of more than 30° and at larger altitudes of the equatorial plane intensity drops more rapidly due to the incompleteness of the magnetic trap. This incompleteness is independent of the particle energy, and it is therefore improbable for it to be related with the nonconservation of the

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Investigations of Cosmic Rays and Terrestrial Corpuscular Radiation in the Flights of Rockets and Sputniks

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magnetic moment of the particles. Ye. V. Gorchakov, S. Sh. Dolginov, G. I. Golyshev, V. G. Kort, A. I. Lebedinskiy, and I. P. Ivanenko are mentioned. There are 18 figures, 1 table, and 17 references, 14 of which are Soviet.

4

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CHUDAKOV, A.YE.

AUTHORS: Dobrotin, N.A.; Gdalevich, G.L.; Chudakov, A.E.

TITLE: Georgy Nikolayevich Ternov (On His 50th Birthday)

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol. 72, No. 1, pp. 193 - 195

ABST: Georgy Nikolayevich Ternov celebrated his 50th birthday on July 10, 1960. The beginning of his scientific activity coincided with the beginning of an intensive research on cosmic rays (1951-1952). By his first studies he built the foundation for the present-day methods of investigating cosmic rays inside and outside of the stratosphere by means of radio signals emitted by automatic devices. From the start, Ternov worked in close contact with Academician S. V. Skobel'tsyn. In 1939, he completed a series of studies on cosmic rays in the stratosphere, measured at various latitudes. Stratospheric measurements made by Ternov from 1946 to 1949 yielded particularly detailed information on the nature of primary radiation. Basing on rules found by experiments

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to govern the absorption of the primary components in the atmosphere, Ternov reached an important conclusion concerning a strong interaction of the primary particles of cosmic radiation with matter. In 1949, S. N. Vernov headed an expedition of Soviet physicists to the equatorial latitudes in the Indian Ocean. Stratospheric investigations made in the course of that expedition yielded convincing evidence of the existence of the disputed, so-called east-west asymmetry and of the positive charge of particles of cosmic radiation. For his research of cosmic radiation in the stratosphere, Ternov was distinguished with the Stalin Prize of 1st Class in 1949. From 1947 to 1949, Ternov organized comprehensive studies of the interaction of high-energy protons with matter in the stratosphere. Collisions of protons with atomic nuclei were found to give rise to an electron-photon component of cosmic radiation. This allowed the assumption that rapidly decaying mesons giving rise to the formation of photons and electrons are produced in the course of such processes. This hypothesis was confirmed by the discovery of π^0-mesons. In 1949 and 1951, Ternov and collaborators obtained experimental data confirming the presence of similar cascade processes in 1010-ev primary cosmic particles. Ternov supervised comprehensive research work on the

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interaction of cosmic rays with matter and obtained an insight into the mechanism of the formation of secondary cosmic rays in the atmosphere. He became thus possible to describe this process quantitatively. On Ternov's initiative, elementary processes of the interaction of $10^{17} - 10^{19}$ ev particles with atomic nuclei are being studied from a stratoplane. Under his supervision, a first-class laboratory was established at Moscow State University (Moscow State University) to serve for research work on interaction of ultrahigh-energy particles ($10^{14} - 10^{16}$ ev) with matter. The USSR network of stations for the permanent recording of cosmic rays was established with his participation, and is now operating under the IGY program. In acknowledgment of his scientific achievements, Ternov was elected Corresponding Member of the Academy of Sciences USSR (Academy of Sciences USSR) in 1953. He was awarded the Lenin Prize in 1960 for his discovery and research of the muon radiation built of the earth. S. N. Vernov is the head of the Nuclear Physics Institute of Moscow State University (Moskovskiy Gosudarstvennyy Universitet), and runs the special section of the fizicheskiy fakul'tet MGU (Department of Physics at the MGU). There are 1 figure and 17 Soviet references.

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CHUDAKOV, A.YE., NESTEROVA, N.M., DADYKIN, V.L., ZATSEPIN, G.T.,

"A Search for Photons with the Energy of 10^{13} ev. From Discrete Sources of Cosmic Radiation,"

report presented at the Intl. Conference on Cosmic Rays and Earth Storms, Kyoto, Japan, 4-15 Sept 1961.

34350

S/203/61/001/006/002/021
D055/D113

9,6150
3.2420 (1049, 1482)

AUTHORS: Vernov, S.N.; Chudakov, A.Ye.; Vakulov, P.V.; Gorchakov, Ye.V.; Logachev, Yu.I.

TITLE: Radiation measurements in the outer radiation belt on February 12, 1961, during the rocket flight towards Venus

PERIODICAL: Geomagnetizm i aeronomiya, vol 1, no 6, 1961, 872-874

TEXT: The article deals with data on the Earth's outer radiation belt collected when the Earth-Venus rocket launched on February 12, 1961, was 30,000 - 45,000 km from the Earth's center. The special equipment installed in the hermetic container consisted of a scintillation counter and an СТС-5 (STS-5) gas-discharge counter. The distribution of matter around the NaJ(Tl) crystal and the gas-discharge counter is shown in a table. By reducing the dimensions of the crystal and increasing the resolving power of the electronic system of the counter, the radiation intensity in the belt was correctly registered. Fig. 1 shows the overload characteristics for the counting channels of the scintillation (1) and gas-discharge (2) counters.

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These channels could register up to 10^6 and 10^5 pulsations/sec. respectively. To penetrate the crystal of the scintillation counter and the working volume of the gas-discharge counter, electrons must have an energy of $>$ 3 Mev, protons - an energy of $\geq$ 32 Mev and the bremsstrahlung quanta - an energy of $\geq$ 30 kev. Curves on fig.2 represent the counting speed of the scintillation counter (1), that of the gas-discharge counter after corrections were made according to the curves in fig. 1 (3) and the energy release in the crystal in relation to the distance from the Earth's center (2). As all three curves were more or less parallel, the mean energy release in the crystal for one reading of the scintillation counter was 130 kev and remained constant between 32,000 and 40,000 km and the mean energy of the bremsstrahlung quanta did not vary with distance. The constancy of the mean-energy release showed that no great changes occurred in the spectrum of electrons of the outer radiation belt. A diagram (fig. 3) shows the paths of the interplanetary rocket (curve 1) and those of another three Soviet rockets (curve 2). A comparison of radiation and ionization data concerning the interplanetary rocket and the space rockets no. 1 and 2, showed that the outer radiation belt was stable for a period of 2 years when no magnetic perturbances were recorded. However, this period was not long enough to

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evaluate solar effects on the outer belt, but could be taken as an indication of the absence of such an effect. The space rocket no 3 was launched during a moderate magnetic storm (the change in the vertical and horizontal components of the terrestrial magnetic field was about 250 and 150 γ respectively). The external side of the belt was not measured, but the total energy release in the crystal during the entire flight coincided with that calculated for the rocket no 1 and was 1.5 times less than that of the rocket no 2, i.e. no changes occurred in the mean state of the outer zone during the flight of the rocket no 3 during a moderate magnetic storm. Since measurements were started a few hours after the beginning of a magnetic storm, the radiation intensity in the belt had not yet decreased. On the other hand, it is also possible that not all magnetic storms cause the radiation intensity of the Earth's outer radiation belt to decrease. There are 4 figures, 1 table and 3 non-Soviet references. The three English-language references are: W.H. Hess, J. Geophys. Res.,1960, 65, no 10, 3107; P. Rothwell, C.E. McIlwain. J. Geophys. Res., 1960, 65, no. 3, 799; R.L. Arnoldy, R.A. Hoffman, J.R. Winckler, J. Geophys.Res., 1960, 65, no 5, 1361.

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D055/D113

Radiation measurements ...

ASSOCIATION: Moskovskiy gosudarstvennyy universitet, Institut yadernoy fiziki (Moscow State University, Institute of Nuclear Physics)

SUBMITTED: September, 9, 1961

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27205

S/056/61/041/002/027/028
B125/B138

3,2410

AUTHORS: Zatsepin, G. T., Chudakov, A. Ye.

TITLE: Methods of seeking local sources of high-energy protons

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 2, 1961, 655-656

TEXT: The method proposed by Cocconi for the localization of protons with $E \sim 10^{12}$ ev on the celestial sphere is based on the measurement of the relative delay times of the passage of a front of an atmospheric shower through scintillators. The authors believe that showers caused by 10^{12}-ev protons in the solid angle $\Omega \sim 10^{-3}$ sterad can be recorded more reliably and considerably more simply by using the Cherenkov radiation produced by a shower in the atmosphere. In doing so, the light flash is recorded by a photomultiplier placed in the focal point of a big parabolic mirror. In order to separate the showers according to the pulse coincidences, it is advisable to use several paraboloids in parallel arrangement. A primary photon of 10^{12} ev yields a flux of ~ 50 quanta/m^2. To record such showers the parabolic mirror should have an area of ~ 4 m^2. In the authors' view,

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the method described here is better suited for the detection of photons coming from known radioastronomical objects than the Cocconi method. When the measuring apparatus is mounted on a mountain and larger mirrors are used, even primary photons of less than 10^{12} ev, can be recorded. Another advantage of the authors' method is the relatively large effective area of shower recording (of an order of 10^5 m^2), which ensures high statistical accuracy. Using experimental data on cosmic rays in the atmosphere, the intensity of a photon flux with an energy greater than E at a distance R from the object is estimated to be $I_\Phi(>E) \sim 10^{-5} E_{min}^{\gamma-1} E^{-\gamma} cR^{-2} \bar{\varepsilon}_{cos} M$, where E_{min} ($\sim 10^{-3}$ erg) is the minimum energy of cosmic-ray particles in the object; c is the speed of light; $\bar{\varepsilon}_{cos}$ and M are the density of cosmic-ray energy and the mass of gas in the object respectively. This formula is valid if the energy spectrum of cosmic rays in radio nebulae has the same shape as in the neighborhood of the earth. The expected portion of showers originating from photons within the solid angle $\Omega = 10^{-3}$ is given by $\Delta = (I_\Phi/I_{cos}) \cdot 10^3 = 5 \cdot 10^{10} \bar{\varepsilon}_{cos} MR^{-2} \approx 2 \cdot 10^9 \bar{H}^2 MR^{-2}$. This formula is valid on

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the condition that $\bar{\varepsilon}_{cos} = \overline{H^2}/8\pi$, where H indicates the magnetic-field strength. In the case of the crab nebula, the following relation results from $H = 3 \cdot 10^{-3}$ oe, $M = 10^{33}$ g, and $R = 10^{22}$ cm: $\Delta = 2 \cdot 10^{-7}$. For the center of the Galaxy, $\Delta = 5 \cdot 10^{-4}$ follows from $H = 10^{-3}$, $M = 10^{38}$, and $R = 2 \cdot 10^{22}$. It is seen that even the most favorable estimates yield only very small values of photon intensity. Since the spectrum of cosmic rays in several objects shows more high-energy particles than in the neighborhood of the earth, and since most astrophysical quantities are accurate only up to one order of magnitude, it would be useful to study the most promising objects (center of the Galaxy, radio nebulae) by the method discussed here. There are 3 Soviet references.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences USSR)

SUBMITTED: June 6, 1960

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89610

S/020/60/136/002/013/034
B019/B056

9.9130 (1041, 1046, 1060)

AUTHORS: Vernov, S. N., Corresponding Member of the AS USSR, Chudakov, A. Ye., Vakulov, P. V., Gorchakov, Ye. V., Logachev, Yu. I., and Nikolayev, A. G.

TITLE: Radiation Measurements During the Flight of the Third Cosmic Rocket

PERIODICAL: Doklady Akademii nauk SSSR, 1960, Vol. 136, No. 2, pp. 322-324

TEXT: The third cosmic rocket launched on October 4, 1959 contained a scintillation counter and three gas discharge counters. All gas discharge counters had a wall strength of 50 mg/cm^2 steel sheets and were, in addition, surrounded by several shields. Counter I had a shield made from 3 mm lead + 1 mm aluminum with a counter window of 0.28 cm^2, which was closed by a 0.2 mm thick aluminum sheet. Counter II had the same shield, but without counter window, and counter III was in an aluminum container made from 2.5 mm thick aluminum. The scintillation counter recorded the ionization of the crystal (NaI) and the counting rate. Preliminary results of evaluation of the instrument readings are given from the time from

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